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**Simulation of 3D Chaotic Electroconvection in Shear Flow**[1]
SCOTT DAVIDSON, ALI MANI, Stanford University — Electroconvection, a microscale electrohydrodynamic phenomenon with chaotic features reminiscent of turbulence, provides the dominant transport mechanism in many electrochemical processes where ions are driven through ion-selective surfaces under large applied voltages. Electrodialysis, for example, desalinates water by flowing it between layers of ion-selective membranes with alternating selectivity while an electric field is applied normal to the membranes. This process leads to alternating channels becoming enriched and depleted of ions. Despite its key importance, much about how electroconvection enhances ion transport, particularly in the presence of crossflow, remains a mystery. We present results of 3D direct numerical simulations of electroconvection in a canonical geometry of an electrolyte between an ion-selective membrane and a reservoir with periodic sides subject to applied shear flow. We analyze the effects of crossflow on both flow statistics and qualitative structures in the fully chaotic regime.

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